GOVERNMENT OF PUERTO RICO / OFFICE OF THE GOVERNOR

Environmental
Quality Board

October 22, 1996

Ms Kathleen C. Callahan
Director
Division of Enviromental Planning
and Protection
Environmental Protection Agency
290 Broadway
New York, NY 10007-1866

Dear Ms. Callahan:

Enclosed is the Final Report for the proteject **IDENTIFICATION OF ILLEGAL SANITARY WATER DISCHARGES IN THE MARTIN PEÑA CANAL** that is was developed through Section 104(b)3 funds. This report includes the findings of the water quality samplings performed to quantify the impact in the water quality of Martín Peña Canal, of the illegal sanitary connections to the Figueroa storm water pump station. It does not include the laboratory data for metals analyses due to problems related to the quality control and assurance requirements. As soon as these results are received, we will prepare an "addendum" to this report.

If you have any questions, please contac Mr Robert Ayala at (787) 751-5548.

Cordially,

Lucinda Gigliotty
Director
Water Quality Area

Enclosure

cc: Mr Julio Vázquez
EPA, Region II

NATIONAL PLAZA BUILDING/431 PONCE DE LEON AVE./HATO REY, P.R. 00917
P.O. BOX 11488/SANTURCE, P.R. 00910/TELEPHONE (809) 767-8181

GOVERNMENT OF PUERTO RICO / OFFICE OF THE GOVERNOR

Environmental
Quality Board

Final Report
"Identification of Illegal Sanitary Connections to Storm Water Discharges in the Martín Peña Canal"

The **"Martín Peña Canal"** is a natural canal that connects the San Juan Bay with the San José Lagoon and is part of the San Juan Bay Estuarine System (SJBES), which was declared an estuary of national importance by the Environmental Protection Agency (EPA) . This waterbody is classified by the Water Quality Standards Regulation (WQSR) as SC. These are coastal waters designated for recreational activities such as fishing and boating and for the preservation and propagation of desirable species. The Martín Peña Canal presents a high degree of contamination due to discharges of sanitary waters, garbage and rubble which restains compliance of the uses established in the WQSR for this waterbody.

Since 1986, the Puerto Rico Environmental Quality Board (PREQB) iniciated studies to identify the source of contamination of the SJBES, including the development of an inventory of wastewater disposal methods of the structures bordering these waterbodies. Currently, this inventory includes the wastewater disposal methods of a total of 24,197 structures distributed in 33 sectors near the SJBES.

The findings showed that the system, specifically the Martín Peña Canal receives wastewater discharges from interconnections between waste and storm water systems, from illegal discharges to the storm water systems and from direct discharges to the waterbodies.

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Another source of contamination identified are the storm water pump stations that receive sanitary waters. Although these pump stations were constructed for flood control purposes, there are several of them that need to be activated daily even during dry seasons. The most significant case is the storm water pump station located at the Figueroa neighborhood (stop 18)in Santurce. This pump station, owned by the Department of Natural and Environmental Resourses (DNER), receives a great amount of sanitary waters from an area in Santurce. These sanitary waters discharge to the Martín Peña Canal in the area used by the "Aquaexpreso" transportation system. The data obtained from the DNER for November 1991 to April 1992 showed that this station discharged a total of 441,125,000 gallons of untreated waters to Martín Peña Canal during that period. Most of these discharges were made during dry seasons.

In Fiscal Year 1992, EQB received $45,000 in federal funds under Section 104 (b) 3 of the Clean Water Act, to identify the source of the sanitary water that reaches this storm water pump station. The findings and results of this study are found in the **Progress Report of the Project for the Identification of Illegal Sanitary Connections to Storm Water Discharges in the Martín Peña Canal** that was sent to the EPFA on February 17, 1994 (Appendix 1).

The project developed included a water quality sampling to quantify the impact of the pump station discharge in the water quality of Martín Peña Canal. The samples taken were analyzed to identify bacteriological contamination, nutrients and nine (9) metals. Appendix 2 contains a list of the parameters analyzed, according to the **Quality Assurance Project Plan (QAPP)** revised on March 1994. However, due to several problems related to monitoring procedures and results, three (3) monitoring incursions were necessary. The problems arose and the findings at each monitoring incursion are as follows:

1. **August 29, 1994**

Samples were taken at three (3) monitoring stations:

Station	Description
01	At the discharge of the Figueroa pump station.
02	At Martín Peña Canal, east of the pump station discharge.
03	At Martín Peña Canal, west of the pump station discharge.

The bacteriological samples were analyzed at the PREQB laboratory. The nutrients and metals samples were sent to the United States Geological Survey (USGS) laboratory in Ocala, Florida. Appendix 3 includes the sampling results except data for metals analyses, due to problems related to the quality control and assurance requirements. As soon as these results are received, we will prepare an "addendum" to this report.

The TP, ammonia nitrogen and TKN values were higher at station 01 (pump station discharge). However, NO3 + NO2 nitrogen was higher at station 03 (Martín Peña Canal, west of the pump station discharge). The WQSR does not include standards for neither of these parameters for SC waters. Concerning the bacteriological analyses, the evaluation of the data showed a discrepancy between the results of the analyses and the location of the monitoring stations. Station 03, located downstream of the pump station discharge according to the tide movement, registered fecal coliform values of <1 colonies per 100 milliliters (col/100ml), less than station 02 located upstream of the pump station discharge (see Appendix 3). Furthermore, we found that important information concerning the procedure and conditions of the sampling were omitted. Among these are:

a. The sampling report did not include the climatological conditions (such as rain, sun, wind, among other factors).

b. The QAPP was designed taking into consideration tidal fluctuations. There was no indication of the tidal condition during sampling.

c. The location and description of the monitoring stations did not agreed with the approved QAPP. No reason was submitted for this variation.

d. The report did not indicate if the pump station was activated before the sampling.

For all of these reasons, a new sampling was required for bacteriological analyses (fecal coliform, fecal streptococci and total coliforms).

2. **March 15, 1995**

A new sampling at the pump station and Martín Peña Canal was performed. The samples were taken during the hours in which the tide was at its lowest point, according to the data given by the Meteorological Station in San Juan. Samples were taken during and after the discharge of 75,000 gallons of wastewater to the Martín Peña Canal from the storm water pump station located at the Figueroa sector in Santurce. To correct the previous monitoring deficiencies, samples were taken at five (5) monitoring stations located at the pump station and the receiving waterbody. The description of these stations is as follows:

Station	Description
01	At the pump station discharge
02	At Martín Peña Canal, at the De Diego Expressway bridge.
03	At Martín Peña Canal, 600 ft. east of the canal that receives the discharge from the pump station.

04	At Martín Peña Canal, at the joint with the canal that receives the discharge from the pump station.
05	At Martín Peña Canal, 600 ft. west of the canal that receives the discharge from the pump station.

Appendix 4 includes the results of this sampling. The data showed fecal coliform values that ranged from 6,650 col/100ml (Station 02) to 87.650 col/100ml (Station 05), all of them in violation to the WQSR. An additional sampling was programmed for bacteriological analyses.

3. **March 27, 1995**

As in the previous occasion, the samplings for bacteriological analyses were performed when the tide was at its lowest point, according to the data given by the Meteorological Station in San Juan. The sampling conditions were favorable and samples were taken after activation of the Figueroa pump station. Eventhough the tide was at its lowest point, the effects of the strong breeze over the water surface were noticed.

The results of this sampling can be found in Appendix 5. Fecal and total coliforms values were found as too numerous to count (TNTC) in the dilutions of 0.1, 1.0 and 10 mg/l. Eventhough PREQB does not have a standard for fecal streptococci, the registered values ranged between 17,650 col/100 ml at Station 03 (Martin Peña Canal, 600 ft. east from discharge) to 867,000 col/100 ml at Station 01 (pump station discharge). These results confirmed the fecal contamination problem that we presumed exists in the Martín Peña Canal.

MR/yhs

Doc: 96-005

APPENDIX I

COMMONWEALTH OF PUERTO RICO/OFFICE OF THE GOVERNOR
ENVIRONMENTAL QUALITY BOARD

Water Quality Area

February 18, 1994

Mr. Richard Caspe
Chief
Caribbean Municipal Programs Branch
Region II, 26 Federal Plaza
New York, N.Y.,10276

Dear Mr. Caspe:

Enclosed is the latest Progress Report for the project IDENTIFICATION of ILLEGAL SANITARY CONNECTIONS to STORM WATER DISCHARGES in the MARTIN PEÑA CANAL that is being developed through Section 104(b)3 funds. This report includes the more recent findings detected during the field investigations performed by our technical personnel.

Currently, we are taking additional steps in order to require PRASA the clean up of the obstructed sewer lines in order to finish our investigations at the study area.

Cordially,

Lucrnia Ghigliotty
Director
Water Quality Area

Enclosure

cc: Mr. Julio Vázquez
EPA, Region II

DOC. NAME: CRICASPE
1994-00-23
MR/mr

COMMONWEALTH OF PUERTO RICO / OFFICE OF THE GOVERNOR

Environmental Quality Board

FEB 17 1994

PROGRESS REPORT OF THE PROJECT
FOR THE IDENTIFICATION OF ILLEGAL
SANITARY CONNECTIONS TO STORM
WATER DISCHARGES IN THE
MARTIN PEÑA CANAL

The investigation already performed by the Waterbodies Restoration Division of EQB'S Water Quality Area shows there are several situations, almost all related with deficiencies in the sanitary systems of the Puerto Rico Aqueduct and Sewer Authority (PRASA), that are responsible for the wastewater discharges to the Stop 18 storm sewer pumping station and to the Martín Peña Canal. These deficiences and the interconnections of wastewaters to the storm sewer system are contributing with more than half of the sanitary waters that are reaching this pumping station and are being discharged to the Martín Peña Canal. These situations are illustrated on Map #1 and are described as follows:

1. There is a sanitary line that begins near the Central High School for Fine Arts (Ponce De León Avenue near Stop 20) in Santurce. However, this sanitary line is really functioning as a combined sewer, due to the fact that it receives the sanitary and storm waters discharges from many of the structures located along Ponce De León Avenue in Santurce.

   This system goes from south (Hato Rey) to north (San Juan) and is located at the east sidewalk of the Ponce De León Avenue. Almost all the structures at the east side of this Avenue and one 10 stories building (Ponce De León #1250) located at the west side of the Ponce De León Avenue discharge their sanitary waters to this combined system. Also, there are ten (10) streets at the east side of the Ponce de León Avenue that partially discharge their wastewaters to this combined system.

   The combined sewer system continues through the Ponce De León Avenue up to Tizol Street, where it receives the combined (sanitary and storm) waters from the north side of the Ponce De León Avenue (See #1 in Map #1). This system crosses under the Ponce De León Avenue, continues below "Nuestro Teatro", up to Condado and Del Carmen

Streets. At this point, the flow divides and about 75% of it reaches a storm sewer main trunk, going to the Stop 18 pumping station. The remaining 25% goes to the sanitary line at the Condado and Del Carmen Streets.

2. The sewer system at Del Carmen Street and Condado Corner is obstructed and the sanitary waters backflow to the storm sewer described under item 1 above. This illegal discharge to the storm sewer system was confirmed by dye test.

3. Interconnection from the sanitary sewer system to the storm sewer system at Hipódromo Street corner with Fernández Juncos Avenue. This interconnection receives the sanitary waters from an area comprised by: north- Ponce de León Avenue; south- Fernández Juncos Avenue; east- De Diego Expressway (Tunel Minillas); and west- Hipódromo Street. The storm sewer system goes through the Instituto de Ciegos (School for Blinds) Loaíza Cordero and reaches the Stop 18 pump station.

4. The area from the Fernández Juncos Avenue up to Feria Street does not have a sanitary sewer system and is discharging to a storm sewer at Hipódromo Street corner with Feria Street. The area lacking sanitary sewers includes eight (8) structures, among them an eight (8) stories building.

5. Restrooms of the Instituto de Ciegos (School for Blinds) Loaiza Cordero is discharging to the storm sewer.

6. Interconnection of the sanitary sewer to a storm sewer at Del Carmen Street corner with Figueroa Street.

7. Interconnection from the sanitary sewer to the storm sewer at San Juan Street corner with Navas Street. This situation was confirmed by dye tests.

8. Sanitary waters from Ernesto Cerra Street discharging to the storm sewer system at Fernandez Juncos Avenue The origin of these sanitary waters has not been investigated due to the obstruction of the storm sewer of the Ernesto Cerra Street. The clean-up of the storm sewer system was requested to the Municipality of San Juan without any action being taken up to now.

9. Storm sewer at sidewalk in the Fernández Juncos Avenue, between Monserrate and San Juan Streets receiving sanitary waters. This storm sewer line joins a storm sewer main trunk at Fernández Juncos Avenue, in front of San Juan Street, up to the Stop 18 Pump Station. There are several structures in this area that are pending to be investigated.

10. Sanitary waters from two (2) structures at Ponce de León Avenue, between Figueroa and Hipódromo Streets, discharging to the storm sewer system at Figueroa Street. These structures are: Ponce de León #1309 and Ponce de León #1302. Both structures are three (3) stories buildings.

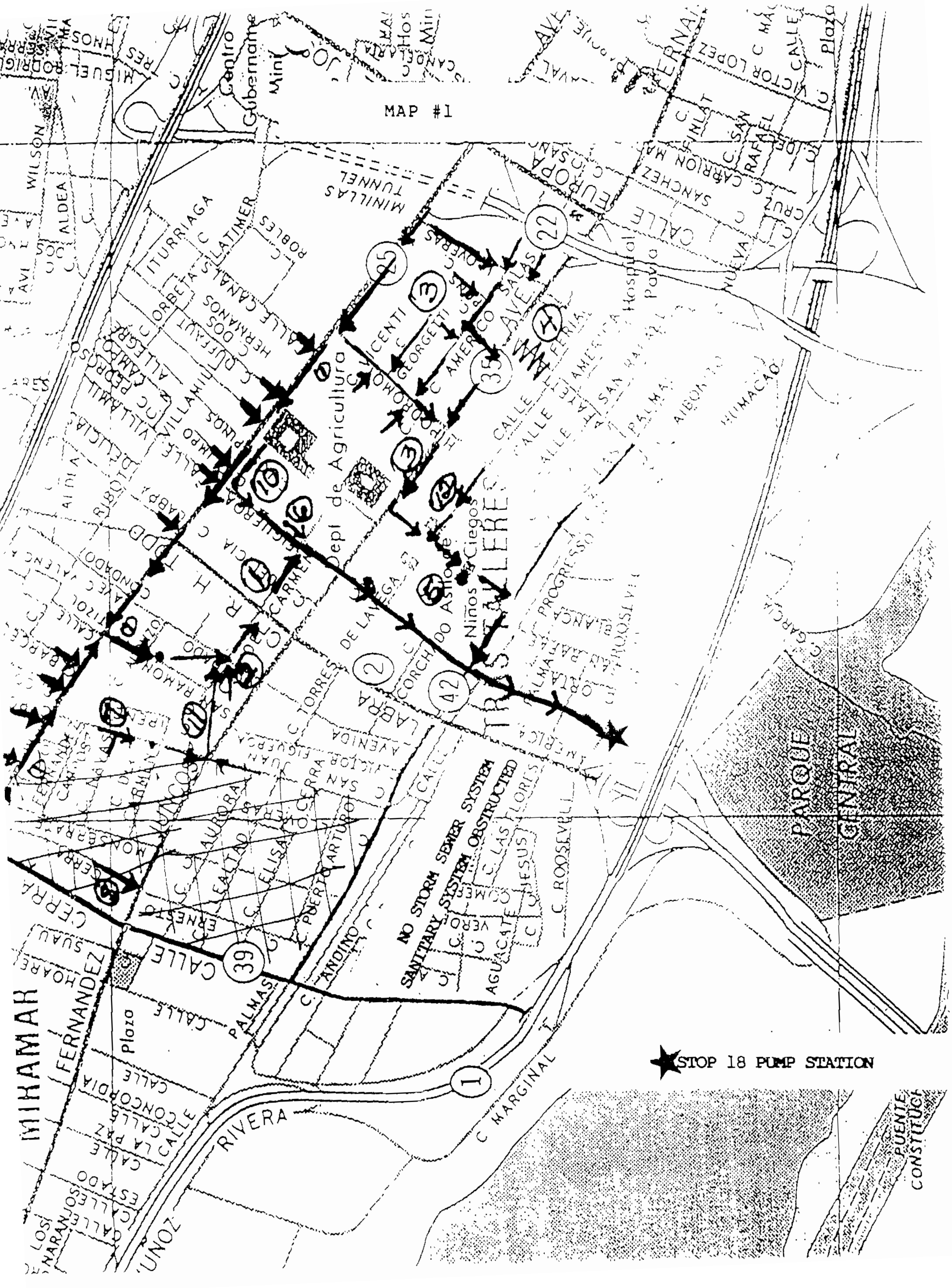
11. Interconnection of sanitary waters to a storm sewer at Fernández Juncos Avenue near San Juan Street. This storm sewer goes through the Ruiz Belvis School yard and through the Café Yaucono industry before joining the storm sewer system at Del Carmen Street. Map #2 shows the area discharging to this storm sewer through this interconnection.

12. Interconnection of the sanitary system at Feria Street to the storm sewer system (near School for Blinds). This sanitary sewer receives the sanitary waters from the Doctor's Hospital and from a clinic and environmental laboratories.

Each of the above situations are shown in Map #1. The situations described in #1,3,11 and 12 are the ones with the greatest amount of sanitary waters to the Stop 18 Pump Station. However, Map #3 shows several areas within the study area that are pending to determine the disposal and/or origin of the sanitary waters to storm sewers. The obstruction of the sanitary and storm sewer systems is the principal obstacle to such determination. The clean up of these storm and sanitary sewers have been requested in several ocassions to PRASA and to the Municipality of San Juan in order to finish our investigations (See appendix I). This clean-up has not yet been done.

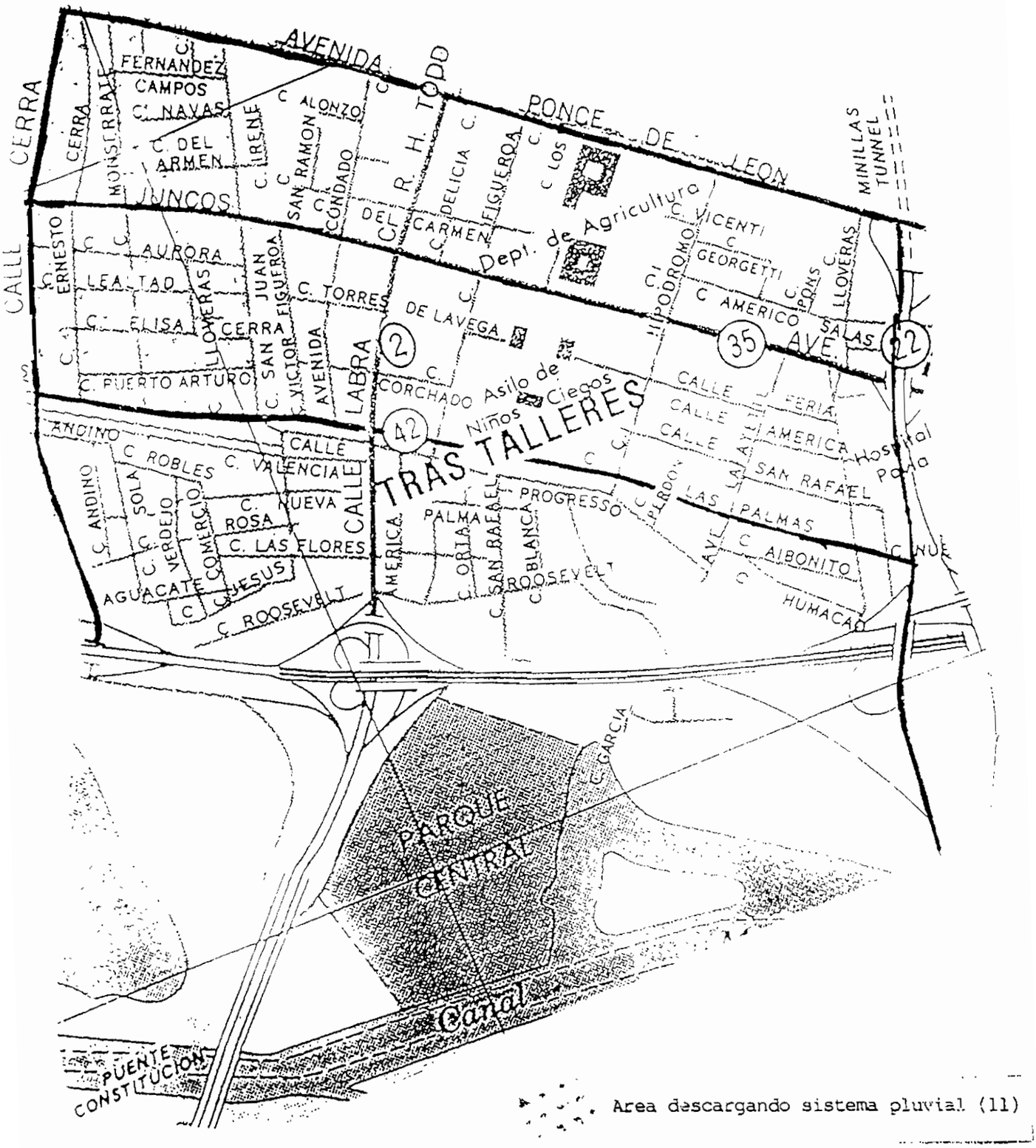
DOC. NAME: PROREP18
1994-00-14
MR/nrb

MAP #1



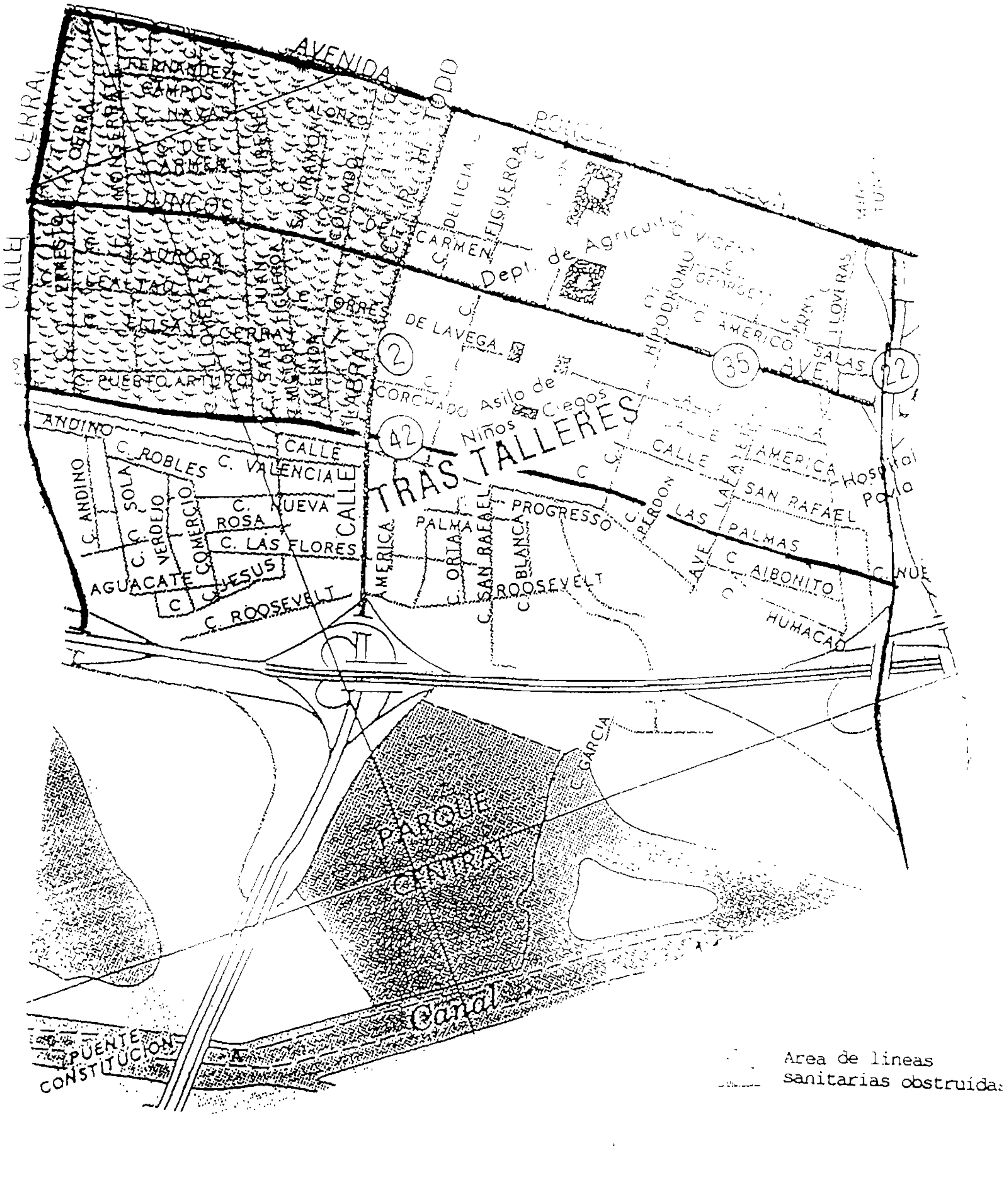
Centro Gubernamental
MINILLAS TUNNEL
Depl de Agricultura
Niños Ciegos
Asilo
PARQUE CENTRAL
NO STORM SEWER SYSTEM
SANITARY SYSTEM OBSTRUCTED
MIRAMAR
FERNANDEZ JUNCOS
CALLE CERRA
CALLE LOIZA
TRASTALLERES
AVE PONCE DE LEON
C MARGINAL
RIVERA
MUÑOZ
C ROOSEVELT
Plaza
STOP 18 PUMP STATION

MAP #2



Area descargando sistema pluvial (11)

MAP #3


AVENIDA
CALLE CERRA
TRAS TALLERES
PARQUE CENTRAL
Canal
PUENTE CONSTITUCION
Area de lineas sanitarias obstruidas

APPENDIX 2

TABLE II

PARAMETER
QAPP-1

PARAMETER	NUMBER OF SAMPLES	SAMPLE MATRIX	ANALYTICAL METHOD REFERENCE	SAMPLE PRESERVATION	HOLDING TIME
NO_2 + NO_3 as N	3	Water	USGS-I-4545-85	$HgCl_2$/NaCl Cool 4°C	28 days
NH_3 - N	"	"	USGS-I-4522-85	"	"
Total Phosphorous	"	"	USGS-I-4600-85	"	"
Chlorides	"	"	USGS-I-2057-84	Cool 4°C	"
Oil & Grease	"	"	EPA 413.1	H_2SO_4 pH <2	"
Total Dissolved Solids (TDS)	"	"	USGS-I-3750-84	Cool 4°C	7 days
Total Suspended Solids (TSS)	"	"	USGS-I-3765-84	"	"
Fecal Coliforms	"	"	Std. Methods 17th 9222 D	"	6 hours
Total Coliforms	"	"	Std. Methods 17th 9222 B	"	"
Hydrogen ion (ph)	"	"	EQB SOP 021.2	N/A	Analyzed in field
Dissolved Oxygen	"	"	EQB SOP 021.3	"	"
Temperature	"	"	EQB SOP 021.1	"	"
Arsenic (As)	"	"	USGS I-3062-85	HNO_3 pH <2 Cool 4°C	6 months
Barium (Ba)	"	"	EPA 208.2	"	"
Cadmium (Cd)	"	"	USGS I-3138-89	"	"
Copper (Cu)	"	"	USGS I-1274-89	"	"
Total Chromium (Crt)	"	"	EPA-200.7	"	"
Manganese (Mn)	"	"	EPA-200.7	"	"
Mercury (Hg)	"	"	USGS I-3462-85	HNO_3/KCr_2O_4 Cool 4°C	28 days
Lead (Pb)	"	"	USGS I-3403-89	HNO_3 pH<2 Cool 4°C	6 months
Zinc (Zn)	"	"	EPA 200.7	"	"

APPENDIX 3

ENVIRONMENTAL QUALITY BOARD
OFFICE OF LABORATORIES
MICROBIOLOGY
WATER QUALITY STUDIES

Study Caño Martín Peña
Body of Water Estuario aguas salada
Date 30/agosto/14

Analyst Signature [signature]
Supervisor Signature [signature]

STA. No.	TOTAL COLIFORMS COUNTS/100ML	FECAL COLIFORMS COUNTS/100ML	FECAL STREPTOCOCCUS COUNTS/100ML	METHOD	DATE	OBSERVATIONS
C I	0	0		MF	29/agosto/14	
Est 01	> 8,000	25,600		MF	29/agosto/14	TNTC en dilución de 35,10 y 1 ml para CT y en 35 y 10 ml para CF
Est 02	$\bar{Y}$=7 8,000	$\bar{Y}$=1,600		MF	29/agosto/14	TNTC en dilución de 35,10 y 1 ml para CT y en 35 y 10 ml para CF Muestra en duplicado
Est 03	>, 8,000	< 1		MF	29/agosto/14	TNTC en dilución de 35, 10 y 1 ml para análisis de 2 duplicados totales
C F	0	0		MF	29/agosto/14	

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Edwin Martínez
LIC. #2336
QUÍMICO LICENCIADO

APROBADO

PUERTO RICO ENVIRONMENTAL QUALITY BOARD
WATER QUALITY AREA

Project Name: Identification of Illegal Sanitary Connections to Stormwater Discharges in the Martín Peña Canal

QAPP Number: 1

Sampling Date: August 1994

Station No.	(500 mg/l) NO_2 + NO_3-N mg/l	TKN mg/l	(1 mg/l) TP mg/l	NH_3N mg/l	Chlorides mg/l	Oil & Grease mg/l	TDS* mg/l	TSS* mg/l	AS µg/l	Ba µg/l	Cd µg/l	Cu µg/l	Crt µg/l	Mn µg/l	Hg µg/l	Pb µg/l	Zn µg/l
MPC - 001	<0.02	25.0	2.8	17.0													
MPC - 002	0.49	1.6	0.25	0.92													
MPC - 003-a	1.1	0.56	0.15	0.44													

*TDS - Total Dissolved Solids

*TSS - Total Suspended Solids

APPENDIX 4

ENVIRONMENTAL QUALITY BOARD
SAMPLING DIVISION

AVE. PONCE DE LEON #431
HATO REY, P.R. 00917

CHAIN OF CUSTODY RECORD

SURVEY 106 Bomba Parada 18 C Caño Martín Peña

SAMPLER (Signature) A.L Cattión, O. Osorio, R. Figueroa

Station Number	Station Location	Date	Time	Samp Type Water comp	Samp Type Water grab	temp °C.	seg no.	Container g	Container p	Volume & Specific	Analysis Requiered	Preserva
001	Descarga de la bomba	950310	1136		✓	27.0	1		✓	1/500 ml	CF-CT, EF	Cool
002	Puente expreso de Diego	950310	1136		✓	26.0	2		✓	1/500 ml	CF-CT, EF	"
004	Ante de la unión a Caño	950310	1209		✓	28.0	3		✓	1/500 ml	CF-CT, EF	"
	M. Peña											
003	600' despues de la unión, Caño M. Peña (Lado derechos)	950310	1355		✓	29.0	4		✓	1/500 ml	CF-CT EF	"
005	600' despues de la unión	950310	1357		✓	29.0	5		✓	1/500 ml	CF-CT, EF	"
	Caño M. Peña lado Izquierdo											
	mirando hacia la bahía											

Dispached by: Signature	Date	Time	Received by (signature)	Date	Time	Temperature
A.L. Cattión	15/marzo 95	1456	Luis Rodríguez Torres	15/marzo 95	1456	0.5 °C

Remarks CF = Coliformes fecales, CT = Coliformes totales, EF = estreptococos fecales

Distribution Orig. Copy Survey Coordination Field F

ENVIRONMENTAL QUALITY BOARD
OFFICE OF LABORATORIES
MICROBIOLOGY
WATER QUALITY STUDIES

Study Caño Martin Peña
Body of Water Estuario

Date 03-17-95

Analyst Signature
Supervisor Signature

STA. No.	TOTAL COLIFORMS COUNTS/100ML	FECAL COLIFORMS COUNTS/100ML	FECAL STREPTOCOCCUS COUNTS/100ML	METHOD	DATE	OBSERVATIONS
CI	0	0	0	MF	03-15-95	-
Est.1	<1	>60,000	>60,000	MF	03-15-95	TNTC en diluciones de 10, 1.0 y 0.1 ml para análisis CF y SF.
Est.2	<1	6,650	8,850	MF	03-15-95	TNTC en diluciones de 10 ml para análisis de CF y SF.
Est.3	$\bar{x}$=<1	$\bar{x}$=9,469	$\bar{x}$=6,425	MF	03-15-95	TNTC en diluciones de 10 ml para análisis de CF y SF. Muestra duplicada.
Est.4	<1	>60,000	>60,000	MF	03-15-95	TNTC en diluciones de 10, 1.0 y 0.1 ml para análisis CF y SF.
Est.5	<1	87,650	44,500	MF	03-15-95	TNTC en diluciones de 10 ml para análisis CF y SF.
CF	0	0	0	MF	03-15-95	

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Edwin Martínez
LIC. #2336
QUÍMICO LICENCIADO

APPENDIX 5

ENVIRONMENTAL QUALITY BOARD
SAMPLING DIVISION

AVE. PONCE DE LEON #431
HATO REY, P.R. 00917

CHAIN OF CUSTODY RECORD

SURVEY: 106 Bomba Parada 18 (Caño Martín Peña)

SAMPLER (Signature): G. Ojeda, L. Figueroa Cabrera, A. L. Carrión

Station Number	Station Location	Date	Time	Samp Type Water comp	Samp Type Water grab	temp °C	seg no.	Container g	Container p	Volume & Specific	Analysis Reguiered	Preservation
001	Desc. de la bomba	950327	1057		✓	28.5	1		✓	1/500 ml	CF-CT-EF	cool 4°C
002	Puente expreso de Diego	950327	1100		✓	29.0	2		✓	1/500 ml	CF-CT-EF	" 4°C
004	Antes de la unión al Caño M. Peña	950327	1132		✓	29.0	3		✓	1/500 ml	CF-CT-EF	" 4°C
003	600' después de la unión Caño M. Peña lado derecho hacia la bahía	950327	1248		✓	27.0	4		✓	1/500 ml	CF-CT-EF	" 4°C
005	600' después de la unión C. Martín Peña lado Izq. hacia la bahía	950327	1248		✓	27.0	5		✓	1/500 ml	CF-CT-EF	" 4°C

Despached by: Signature	Date	Time	Received by (signature)	Date	Time	Temperature
A. L. Carrión	27/03/95	1438	[illegible signature]	27/03/95	1438	1°C

Remarks: CF = Coliformes fecales, CT = coliformes totales, EF = estreptococos fecales

Distribution Orig. Copy Survey Coordination Field Files

ENVIRONMENTAL QUALITY BOARD
OFFICE OF LABORATORIES
MICROBIOLOGY
WATER QUALITY STUDIES

Study Caño Martín Peña
Body of Water Caño

Date 29 de marzo de 1995

Analyst Signature [signature]
Supervisor Signature [signature]

STA. No.	TOTAL COLIFORMS COUNTS/100ML	FECAL COLIFORMS COUNTS/100ML	FECAL STREPTOCOCCUS COUNTS/100ML	METHOD	DATE	OBSERVATIONS
CI	0	0	0	MF	27marzo95	
Est 1	TNTC > 80,000	TNTC > 60,000	867,000	MF	27marzo95	TNTC en diluciones 10, 1 y .1 ml para análisis de CF y CF y en 10 y 1 ml para EF.
Est 2	TNTC > 80,000	TNTC > 60,000	20,850	MF	27marzo95	TNTC en diluciones de 10, 1 y .1 ml para análisis de CT y CF y en 10 ml para EF
Est 3	TNTC > 80,000	TNTC > 60,000	17,650	MF	27marzo95	TNTC en diluciones de 10, 1 y .1 ml para análisis de CT y CF y en 10 ml para EF
Est 4	TNTC > 80,000	TNTC > 60,000	533,000	MF	27marzo95	TNTC en diluciones de 10, 1 y .1 para análisis de CT y CF y en 10 y 1 ml para EF.
Est 5	$\bar{x}$ = TNTC > 80,000	$\bar{x}$ = TNTC > 60,000	$\bar{x}$ = 48,175	MF	27marzo95	TNTC en diluciones de 10, 1 y .1 ml para análisis de CT y CF y en 10 ml para EF muestra en duplicado
CF	0	0	0	MF	27marzo95	

APROBADO

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